Development of high-resolution, satellite-derived vegetation and land surface data sets for the GCIP region and the Conterminous USA.

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ABSTRACT

Coupled land-atmosphere models require information about the type of vegetation present on the land surface and the phenology associated with the annual cycle of the vegetation. Specifically, the dominant land cover types within a grid cell and the percent of green (potentially evapotranspiring) vegetation are required on temporal basis. Additionally, the spatial and interannual variability of the percent green vegetation are required. Recently developed data sets can provide improvement to the presently available information on land use/land cover and percent green vegetation for use in coupled land-atmosphere models. The use of a course 1-degree land cover map in the high resolution mesoscale Eta model has been found to lead to local grid cell sensible/latent heat flux errors of 30% (~100 watts/m^2) of the typical summer central U.S. mid-day value. This surface heat flux error in turn can prompt significant errors in the mesoscale Eta model forecast of planetary boundary layer (PBL) temperature, dew point, and depth, which lead to errors in the convective stability indices (e.g., Lifted Index and Convective Available Potential Energy), and the convective precipitation rate.

The incorporation of course resolution (1^o) land use/land cover (LULC) data into coupled land-atmosphere models can result in large changes in the LULC of two adjacent grid cells. An example would be the transition from a LULC of primarily forest in Southern Missouri to grassland and agriculture in Eastern Kansas. Rather than a distinct boundary between these LULC classes, as currently portrayed in a model that utilizes 1^o data, in reality the LULC changes gradually.

Additionally, the percent of green (potentially evapotranspiring) vegetation within each grid cell is also required in most coupled land-atmosphere models. The limitations of the current surface parameterization data used in the models include the spatial resolution, which is as much as an order of magnitude greater than the finest resolution of some of the available models.

In summary, the currently used land cover and percent green vegetation data sets are a conglomeration of several publicly available data sets. The underlying objective of this project is to improve the results of the coupled land-atmosphere model output through the development of satellite-derived land use/land cover and fractional green vegetation from a single, self-consistent, data source of finer resolution than the presently available model input data. These data sets described below will be minimally prepared for the **GCIP region and the remainder of the conterminous USA**, with prototype products produced on a global basis.

The **specific objectives** of this project are to develop, evaluate, and test the following data sets for their improvement to coupled land-atmosphere models.

1) Land use/land cover data sets that will minimally include the International Geosphere-Biosphere Programme (IGBP, Figure 1), Simple Biosphere Model (SiB) and Biosphere Atmosphere Transfer Scheme (BATS) classes (all available at a 1-km resolution, *http://edcwww.cr.usgs.gov/landdaac/glcc/glcc.html*). The addition of an "urban" class, derived from the Defense Meteorological Program Operational Linescan System data (*http://www.ngdc.noaa.gov/dmsp/dmsp.html*), will be included in the data sets.

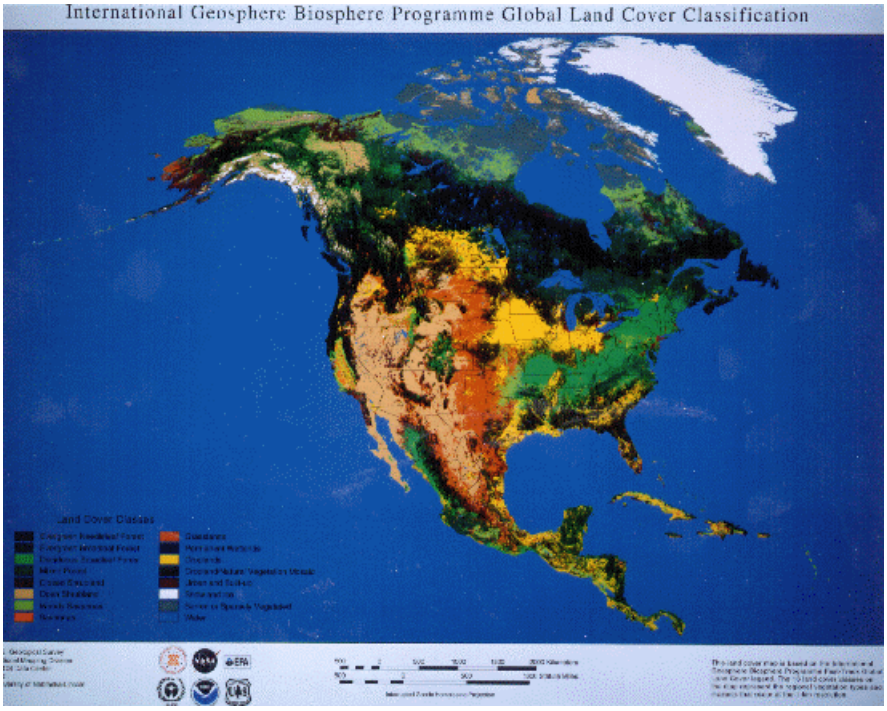

Figure 1.

2) A monthly climatological data set of the fractional presence of green vegetation. This data set will be developed (Gutman and Ignatov, 1998) from a 5-year biweekly normalized difference vegetation index data set (e.g., Figure 2) that is available for the

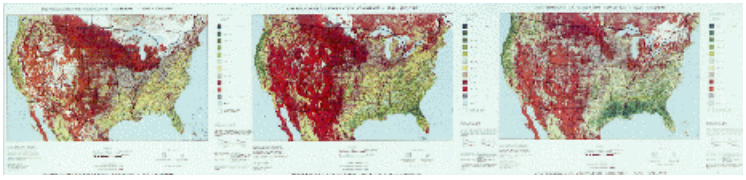

Figure 2.

conterminous USA at a 1 km resolution (additional information at; *http://edcwww.cr.usgs.gov/Webglis/glisbin/guide.pl/glis/hyper/guide/usavhrr*).

3) The development of products, nominally at 20-km grid cell size, that include the three predominant land use/land cover classes in each grid cell and a monthly climatology of the fractional presence of green vegetation associated with the three predominant vegetation types. The data sets will include the urban class from objective 1, and an algorithm will be recommended for extraction and binning the three most dominant land use/land cover classes for each model grid cell.

4) Development of a prototype global 1-km land use/land cover product similar to that described in 1) above, and an 18-month climatology of the fractional presence of green vegetation at a 1-km resolution, similar to that described in 2) above. These data sets will be produced from 1-km data available through the IGBP Global Land 1-km AVHRR data set (Figure 3, *http://edcwww.cr.usgs.gov/landdaac/1KM/1kmhomepage.html*).

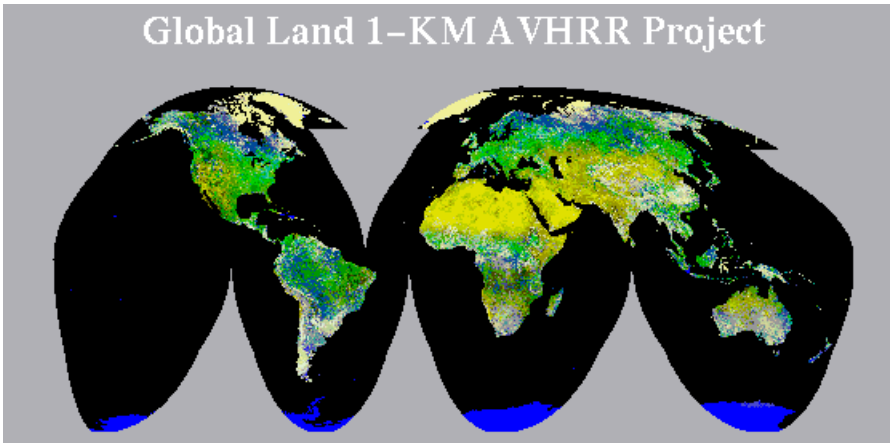

Figure 3.

Reference: Gutman, G. and A. Ignatov. 1998. Derivation of Green Vegetation Fraction from NOAA/AVHRR for use in Numerical Weather Prediction Models, (accepted, Intl. J. Remote Sensing).